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THERMAL FOG TESTS AGAINST *AEDES AEGYPTI* (L.) AND *ANOPHELES ALBIMANUS* (WIED.)[1]

W. L. JAKOB[2]

The use of insecticidal fogs is an integral part of the control program of most mosquito abatement districts. Although in international malaria eradication efforts primary emphasis is placed on treatment of premises with residual deposits, the use of other application techniques in certain problem areas is indicated since existing measures have failed to interrupt transmission. Rachou *et al.* (1965) reported that failures in malaria eradication in some areas of El Salvador are due to social characteristics of the native populations and/or ecological habits of the vector species, *Anopheles albimanus.* Insecticidal fog may also prove to be a useful and necessary adjunct to source reduction and premises treatments in the *Aedes aegypti* eradication program in the United States (Schliessmann 1964). This paper presents results of tests with thermal fogs against *A. albimanus* and *Ae. aegypti* made at Savannah, Georgia, in 1965.

METHODS. The test area, used in previous studies (Schoof *et al.* 1962), was a sparsely populated subdivision located about 3 miles from the laboratory. Vegetative cover in the areas bordering the roads varied from open grassy zones to areas of dense brush 4 to 10 feet tall interspersed with pine trees up to 25 feet in height (Fig. 1). Exposure stations were situated on each of three roads (270 feet apart) which were near the center section of the 1,320-footpath traveled by the fogging vehicle in each test. On each road the stations were located along the edge 150 and 300 feet from the line of travel of the equipment. Depending on prevailing wind conditions, the stations were placed on that side of the road which favored the drift of the fog over the test cages. All applications were made with a Leco 120[3] thermal fog generator calibrated to deliver 40 gallons per hour and operated at a burner temperature of 850° F. Truck speed was 5 miles per hour.

Three-day-old sugar-fed specimens of DDT-dieldrin resistant *Ae. aegypti* (Charlotte Amalie strain) and dieldrin-resistant *A. albimanus* (Tecomatal strain) were confined (Fig. 2) in screen wire cages (3¼ in. diameter x 6 in.) closed with nylon tulle. Two cages, one with each species, were suspended horizontally on a stake at a level 6 feet above the ground. Each cage contained from 60 to 100 female *Ae. aegypti* or from 40 to 75 *A. albimanus* which previously had been anesthetized with CO_2 for transfer purposes. Specimens were provided with cotton pads saturated with 10-percent honey solution until their transport to the field for testing. Following discharge of the fog the cages were left in position for a period of 10 minutes to allow time for the aerosol particles to drift through the test area. Each cage was then wrapped in paper towels (Fig. 2) and placed in a cardboard box.

When all cages had been removed, they were transported to the laboratory where the mosquitoes were anesthetized with CO_2, transferred to clean cages and furnished honey pads. Test specimens were held at 80° F. and 70 percent relative humidity for mortality counts at about 18 hours after exposure. Check insects were

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[1] From the Biology/Chemistry Section, Technology Branch, Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Savannah, Georgia.

[2] Present address: Aedes aegypti Eradication Branch, Communicable Disease Center, Atlanta, Georgia.

[3] Names of commercial manufacturers and trade names are provided for identification purposes only. Their mention does not constitute endorsement by the Public Health Service or by the U. S. Department of Health, Education, and Welfare.

FIG. 1.—One of three roads used as test area. Exposure stakes visible at right side of road.

TABLE 1.—Results of thermal fog tests* conducted against caged adult *Aedes aegypti* and *Anopheles albimanus*, Savannah, Georgia, 1965.

Insecticide	Oz. per gal.	Percent mortality at indicated distances			
		150 ft.		300 ft.	
		Range†	Average†	Range†	Average†
		Aedes aegypti			
Malathion	5	97–100	99	73–100	91
	6	74–100	93	80–100	93
Naled	2	53–100	78	10–88	48
Fenthion	1	86–100	96	78–99	92
Dursban	1.5	74–100	92	71–100	88
		Anopheles albimanus			
Malathion	5	99–100	>99	87–100	98
	6	89–100	98	.....	100
Naled	2	80–100	92	31–96	67
Fenthion	1	90–100	87	78–100	91
Dursban	1.5	87–100	95	81–100	92

* Average of 6 tests except with Dursban, which was tested 4 times.
† Values represent three replicates in each test.

transported to the test site prior to each test and then returned to the laboratory grounds where they were suspended outdoors in the same manner as the treated specimens. These specimens were processed similarly to the exposed insects.

All insecticides[4] were formulated in No. 2 fuel oil. The formulations were prepared from malathion (10 pounds per gallon), naled (14 pounds per gallon), fenthion (4 pounds per gallon) and Dursban (4 pounds per gallon). To prevent the formation of precipitates (Rathburn *et al.* 1964) Thiosperse was used in malathion formulations and Ortho Additive 10-30 in naled formulations, each at 0.4 percent by volume.

RESULTS. The data (Table 1) indicate that thermal fogs of malathion (5 or 6 ounces per gallon) and fenthion (1 ounce per gallon) gave markedly higher average kill of *Ae. aegypti* in six tests than did naled (2 ounces per gallon). In four tests with Dursban (1.5 ounces per gallon) the results were promising, but further tests are needed at this and higher dosages.

With *A. albimanus*, malathion was superior to Dursban, fenthion, and naled. At 5 or 6 ounces per gallon malathion gave 98 percent or higher average mortality of this species at 150 and 300 feet. With naled, poor kill in one replicate in each of three tests reduced the average values at the 150-foot distance. At 300 feet, results with naled were poor in five of the six tests, only one of which was due to low kill in one replicate. Dursban (1.5 ounces per gallon) gave promising results in the four tests run.

DISCUSSION. The data indicate that dispersal of thermal fogs by ground equipment can give effective kills of *Ae. aegypti* and *A. albimanus*. Malathion gave good kills of both species when dispersed in formulations containing 5 or 6 ounces per gallon as did fenthion at 1 ounce per gallon and Dursban at 1.5 ounces per gallon. Poor results were obtained with naled at 2 ounces per gallon against *Ae. aegypti* and at the 300-foot distance with *A. albimanus*. The specific cause of these poor results with naled was not apparent. The influence of uncontrollable variables inherent in field evaluations, especially of wind-borne aerosols, is emphasized by the range in mortality obtained with most of the treatments.

FIG. 2.—Exposure site showing removal of cage from stake and cage in place.

[4] Provided through the courtesy of these companies: American Cyanamid Company, Princeton, New Jersey (malathion); California Chemical Company, Richmond, California (naled); Chemagro Corporation, Kansas City, Missouri (fenthion); Dow Chemical Company, Midland, Michigan (Dursban).

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